Electroactive Polymers – Current Capabilities and Challenges

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ABSTRACT

In the last ten years, new EAP materials have emerged that exhibit large displacement in response to electrical stimulation enabling great potential for the field. To develop efficient EAP that are robust for practical applications there is a need to establish an adequate EAP infrastructure. This requires developing adequate understanding of EAP materials' behavior, as well as effective processing and characterization techniques. Enhancement of the actuation force requires understanding the basic principles using computational chemistry models, comprehensive material science, electro-mechanics analytical tools and improved material processing techniques. Efforts are needed to gain better understanding of the parameters that control the EAP electro-activation force and deformation. The processes of synthesizing, fabricating, electroding, shaping and handling need to be refined to maximize the EAP materials actuation capability and robustness. Methods of reliably characterizing the response of these materials are required to establish database with documented material properties in order to support design engineers considering use of these materials and towards making EAP as actuators of choice. Various configurations of EAP actuators and sensors need to be studied and modeled to produce an arsenal of effective smart EAP driven system. The development of the infrastructure is a multidisciplinary task involving materials science, chemistry, electro-mechanics, computers, electronics, and others. This paper will be a review of the status of the EAP field and the challenges to practical application of EAP materials as actuators.

Keywords: Electroactive Polymers, EAP, Artificial Muscles, EAP Actuators, Active Polymers, Manipulators

Biography: Dr. Yoseph Bar-Cohen is a physicist specialized in ultrasonic NDE and electroactive materials and mechanism. He is a Senior Research Scientist, Group Leader and the Resident NDE Expert at the Jet Propulsion Laboratory (JPL) responsible for the NDEAA Technologies (http://ndeaa.jpl.nasa.gov/). Dr. Bar-Cohen is also an Adjunct Professor at the University of California, Los Angeles (UCLA) and a Fellow of ASNT. Two notable discoveries of Dr. Bar-Cohen are the leaky Lamb waves (LLW) and polar backscattering phenomena in composite materials. He received his Ph. D. in Physics (1979), The Hebrew University, Jerusalem, Israel. In 1991, he established the JPL's NDEAA Lab that led to a series of innovative concepts and mechanisms, including an ultrasonic drill that is being considered for planetary exploration missions. His scientific and engineering accomplishments have earned him the 2001 NASA Honor Award: NASA Exceptional Engineering Achievement Medal and the 2001 SPIE's NDE Life Time Achievement Award.

ACKNOWLEDGEMENT

The research at Jet Propulsion Laboratory (JPL), California Institute of Technology, was carried out under a contract with National Aeronautics Space Agency (NASA) and Defense Advanced Research Projects Agency (DARPA).

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